SUMMARY

Denver, Colorado is the seventh¹ most congested large urban area (over 1 million and less than 3 million population) in the United States. In addition, in the next 20 years more than one million people will move to the Denver metro area². To handle the growing transportation needs, the Regional Transportation District (RTD) has developed a 12-year comprehensive plan (known as FasTracks) to build and operate rail lines, expand and improve bus service, and almost double the capacity of park-n-Rides throughout the region.

Currently, there are over 27,000 spaces at 78 park-n-Rides available for transit patrons, which are expected to grow to 48,000 parking spaces at over 100 park-n-Rides with the FasTracks plan by the year 2030. A Parking Management programme will then be required to preserve the parking capacity and also effectively manage the parking spaces by instituting a fee policy for transit patrons.

A Parking Revenue Model was developed as a part of the Parking Management programme to determine the estimated annual revenue if the fee policy is implemented in future. However, it should be noted that generation of revenue is not the purpose of the Parking Management Programme. This paper outlines a general process of developing the parking revenue model, identifies the key issued considered and discusses the challenges faced in developing the model. An overview of the model's functional structure is also presented.

The paper also discusses the policy implementation assumptions, numerous variables used in the model such as percentage split of resident and non-resident patrons and extended stay travellers, parking fees for different user types, parking capacity utilization, and the use of historic survey data to determine the appropriate input values for different variables used in the model.

This paper will serve as an informational report for other US regional transit agencies in planning and developing parking revenue models and similarly structured transport authorities in Europe.
INTRODUCTION

In order to effectively manage patron demand on the park-n-Ride system, RTD is planning to implement a parking management programme that institutes a fee policy for certain transit patrons. The Parking Management Programme would address several objectives listed below:

- Preservation of park-n-Ride capacity for transit patrons
- Shift demand from over-capacity park-n-Rides to under-utilized park-n-Rides
- Distribute park-n-Ride system costs more equitably among in-district and out-of-district users
- Distribute park-n-Ride system costs more equitably among users and non-users of park-n-Rides

To achieve these objectives, the parking management programme would institute fees for three categories of park-n-Ride use:

- A portion of the parking spaces at a park-n-Ride would be designated as Reserved. Patrons would pay a monthly fee to park in a reserved space
- Patrons who reside outside of the RTD district would pay a fee to park
- Patrons who park for more than one day (typically airport patrons) would also pay a fee to park

The parking management programme will generate revenue, as well as require capital, operating and maintenance costs. For revenue estimation, a model was needed given the wide variety of factors that affect the potential revenue, such as:

- Selection of park-n-Rides where parking management programme is implemented
- Capacity of the park-n-Ride, including expansion as FasTracks is constructed
- Utilization rate for each park-n-Ride
- Amount of reserved patrons
- Amount of in-district and out-of district patrons
- Amount of extended stay patrons
- The fee pricing structure
Estimates of the costs are produced separately, and the Parking Revenue Model simply uses a unit cost per programme park-n-Ride to calculate net revenue from gross revenue. The Parking Revenue Model is prepared as a spreadsheet using Microsoft Excel.

MODEL DEVELOPMENT ASSUMPTIONS

A number of meetings were held with the RTD staff to determine different policy implementation assumptions for the numerous variables to be used in developing the model. These included fee structures, percentage split of resident and non-resident patrons and extended stay travellers, parking fees for different user types, parking capacity utilization, future growth rates and use of historic survey data to determine the appropriate input values for different variables used in the model.

The following initial assumptions were made while developing the model. However, note that not all of the initial assumptions are permanent; many can be changed to create alternative revenue generating scenarios. Also, the default numerical values used in the model provide only a base reference. The user may override these numerical values based on the actual survey data or sound engineering judgment.

1. The RTD park-n-Rides are divided into two basic types for accounting purpose:
   - Base park-n-Rides – park-n-Rides existing in the RTD parking system
   - FasTracks park-n-Rides – future park-n-Rides that will be constructed as a part of the FasTracks programme

2. It was also assumed that if a Base park-n-Ride falls on a FasTracks line in future, at that point in time the Base park-n-Ride will become a FasTracks park-n-Ride.

3. Base (existing) park-n-Rides revenue/expense account will be kept separate from the FasTracks (future) park-n-Rides revenue/expense account.

4. Base park-n-Rides will start generating revenue in year 2009 with a horizon year of 2030.

5. For the Base park-n-Rides, the existing parking capacity utilization values will be obtained from the ‘Year 2006 RTD Parking Usage Survey Data’.

6. For the Base park-n-Rides, the historic average utilization growth rates are obtained from the ‘RTD Parking Usage Survey Data (Year 2003 through 2006)’.
7. For the Base park-n-Rides, the historic average utilization growth rates obtained are used as a guideline to determine parking occupancy in future years.

8. It was assumed, for calculations purpose, that the maximum occupancy at any given Base park-n-Ride will not exceed 95 percent in future years.

9. The revenue generation policy will be implemented in year 2009 at Base park-n-Rides that are at least 80 percent full.

10. It was assumed that the FasTracks lines will begin operations as per the planned schedule.

11. Unlike Base park-n-Rides, no historic data is available for the opening day parking capacity utilization at FasTracks park-n-Rides. Hence, it was assumed that FasTracks park-n-Rides will be 80 percent full upon opening.

12. FasTracks park-n-Ride utilization is assumed to grow at 2 percent each successive year, until a maximum parking occupancy of 95 percent is reached and will remain at that level until year 2030.

13. Several FasTracks parking lots will be expanded beyond opening day capacities. It was assumed that the expansions will occur in year 2028. Hence, the revenue generation calculations from year 2028 through 2030 use 2028 revised parking capacity values.

PARK-N-RIDE PATRON PERCENTAGE ASSUMPTIONS

1. For revenue calculations, transit patrons are divided into three categories:
   - Residents – from within the RTD district
   - Non-Residents – from outside the RTD district
   - Extended Stay Travellers – transit patrons parking for extended periods, typically airport travellers

2. The following parking reservation assumptions are made:
   - Percent of parking spaces reserved by residents and non-residents at any park-n-Ride cannot exceed 15 percent of the total capacity (per legislation enabling RTD to implement fees at park-n-Rides)
   - Percent of parking spaces reserved by non-residents and percent of parking spaces occupied by non-residents non-reserved at any park-n-Ride can only be 15 percent or less
- Extended Stay Travelers will park on an average for 4.1 nights

- Currently, Extended Stay Travelers parking is available in the model at SkyRide park-n-Rides only. However, with FasTracks lines, in future each FasTracks park-n-Ride will have an Extended Stay Travelers parking facility

- It is assumed that the Extended Stay Travelers will utilize 9 percent of the available parking spaces at any park-n-Ride (from RTD market research surveys)

### PARKING CHARGES ASSUMPTIONS

<table>
<thead>
<tr>
<th>Parking Charges</th>
<th>Residents</th>
<th>Non-Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Parking</td>
<td>Free</td>
<td>$4/day or $40/month</td>
</tr>
<tr>
<td>Reserved Parking</td>
<td>$20/month</td>
<td>$50/month</td>
</tr>
<tr>
<td>Extended Stay Travelers Parking (SkyRide and FasTracks park-n-Rides)</td>
<td>$2 per 24 hours</td>
<td>$4 per 24 hours</td>
</tr>
</tbody>
</table>

Table 1 – Parking Charges Assumptions

- It is assumed that 1/3 of the non-resident, non-reserved transit patrons will pay daily and 2/3 will pay monthly parking charges

- It is also assumed that out of 9 percent extended stay travellers, 85 percent will be residents and 15 percent will be non-residents

- Even though various payment options (daily/monthly) will be made available to transit patrons, the Model accepts only Blended Daily Parking Rates as an input. Please refer to the ‘Daily Rate Calculator’ tab provided in the Model to calculate Blended Daily Parking Rates

### GENERAL ASSUMPTIONS

- A turnover rate is a ‘ratio of total number of motorists that use a park-n-Ride facility in a single day compared to the number of parking spaces available at that site’. In the model a turnover rate of 1.00 is used, meaning each parking space will be utilized only once on any given day. However, the users are allowed to input a different turnover rate based on actual survey data or sound engineering judgment
• Yearly revenue at Base and FasTracks park-n-Rides is calculated assuming 22 days/month or 264 days/year

• Yearly revenue at Extended Stay Travelers parking lots (such as SkyRide and future FasTracks park-n-Rides) is calculated assuming 30 days/month or 360 days/year

• Capture Rate is the ratio of actual number of pay-and-park patrons detected by the system to the total number of pay-and-park patrons using the system on a given day. The capture rate used in the model is 80 percent

PARKING REVENUE MODEL OPERATION

The Parking Revenue Model is prepared as a spreadsheet using Microsoft Excel. A total of eight tabs were created. For the first-time users a checklist is provided to assist in using the model in the most efficient manner.

1. The **Instructions tab** provides detailed checklist on how to navigate through the model and obtain the results. A screenshot of Instructions tab is shown in Figure 1.

![Figure 1 – Instructions tab](image)

2. The **Assumptions tab** contains some static assumptions that can be changed and some dynamic assumptions that can be changed by the user to create alternate scenarios. The following assumptions can be changed.

   - Base park-n-Rides - Maximum Occupancy at any park-n-Ride not to exceed X percent

   - Maximum Occupancy at any FasTracks park-n-Ride not to exceed X percent
- Assumed Turnover Rate
- Number of days/year to calculate Yearly Revenue at Base & FasTracks park-n-Rides
- Number of days/year to calculate Yearly Revenue at SkyRide/Airport park-n-Rides
- Assumed Capture Rate
- Operating Cost per park-n-Ride

Users are allowed to change most of these values to create alternative scenarios.

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Parking Revenue Model</th>
<th>9/12/2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base pNRs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Base pNRs - First Revenue Generating Year 2009, Horizon Year 2030.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Base pNRs - Use Historic Growth Rate to Determine Future Occupancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Base pNRs - Maximum Occupancy at any pNR not to exceed 55.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FasTracks pNRs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. FasTracks Line开始 Generating Revenue Year 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Maximum Occupancy at any FasTracks pNR not to exceed 55.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Assume FasTracks pNRs 95% full in 2020, even with additional capacity.</td>
<td></td>
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<tr>
<td>General</td>
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<td></td>
</tr>
<tr>
<td>1. FREE Daily Parking for Residents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Assumed Turnover rate 1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: The Turnover rate is globally applied in the model and should be used with caution</td>
<td></td>
<td></td>
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<tr>
<td>3. Yearly Revenue calculated assuming 225 days/month, 264 days/year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Yearly Revenue at SkyRide/Airport pNRs calculated assuming 30 days/month, 360 days/year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Assumed Capture Rate 80.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. All Calculations Assume 2005 dollars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Assume 2002-2005 Growth Rate will extend to 2030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. The Calculations Assume a Flat Fee (no Hourly Rates) for Parking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Some of the Parking Lots were expanded between 2002 and 2006. Utilisation is based on Percentage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Costs</th>
<th>Item</th>
<th>Description</th>
<th>Per</th>
<th>Cost/FNR</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

Figure 2 – Assumptions tab

3. The **Select Base park-n-Rides tab** contains a list of all Base park-n-Rides in the system and a ‘Selection’ check box next to each park-n-Ride. User can Select the checkbox (turns green) if the fee policy will be implemented at that park-n-Ride.

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4. The **Select FasTracks park-n-Rides tab** contains a list of all FasTracks park-n-Rides in the system and a ‘Selection’ check box next to each park-n-Ride. User can Select the checkbox (turns green) if the fee policy will be implemented at that park-n-Ride. Assuming that the Capacity at increase at some FasTracks park-n-Rides in 2028, the second checkbox, if selected will generate revenue based on year 2028 revised capacity from 2028 through 2030.

5. The **Enter Base park-n-Rides Data tab** provides a list of all Base park-n-Rides currently existing in the RTD parking system. Next to each park-Ride, input boxes are provided for each variable that can be changed to create alternative scenarios. The following variables can be changed to create alternative scenarios.

- Percent of parking spaces reserved by residents
- Percent of parking spaces reserved by non-residents

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• Percent of parking spaces occupied by non-residents, non-reserved
• Percent of extended stay travelers
• Initial percent capacity utilization
• Percent capacity utilization at which Base park-n-Ride will start generating revenue
• Assumed annual utilization growth rate
• Reserved parking charges per day for residents
• Reserved parking charges per day for non-residents
• Unreserved parking charges per day for non-residents
• 24-hour parking charges for extended stay travelers
• Maximum Occupancy at any FasTracks park-n-Ride not to exceed X percent

<table>
<thead>
<tr>
<th>Park-n-Ride Name</th>
<th>Year 2006 Capacity</th>
<th>% of Parking Spaces Reserved by Residents (%)</th>
<th>% of Parking Spaces Reserved by Non-Residents (%)</th>
<th>% of Parking Spaces Occupied by Non-Residents, Non-Reserved (%)</th>
<th>Extended Stay Travelers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport Bvd/40th Ave*</td>
<td>1,079</td>
<td>12.75%</td>
<td>2.25%</td>
<td>15.00%</td>
<td>9.00%</td>
</tr>
<tr>
<td>Alameda/Havana</td>
<td>126</td>
<td>12.75%</td>
<td>2.25%</td>
<td>15.00%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5 – Enter Base park-n-Rides Data tab

6. The **Enter FasTracks park-n-Rides Data tab** provides a list of all future FasTracks park-n-Rides. Next to each park-Ride, input boxes are provided for each variable that can be changed to create alternative scenarios. The following variables can be changed to create alternative scenarios.

• Percent of parking spaces reserved by residents
• Percent of parking spaces reserved by non-residents
• Percent of parking spaces occupied by non-residents, non-reserved

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- Percent of extended stay travelers
- Assumed percent capacity utilization at opening
- Assumed percent capacity utilization at which FasTracks park-n-Ride will start generating revenue
- Assumed annual utilization growth rate percent
- Reserved parking charges per day for residents
- Reserved parking charges per day for non-residents
- Unreserved parking charges per day for non-residents
- 24-hour parking charges for extended stay travellers

<table>
<thead>
<tr>
<th></th>
<th>% of Parking Spaces Reserved by Residents (%)</th>
<th>% of Parking Spaces Reserved by Non-Residents (%)</th>
<th>% of Parking Spaces occupied by Non-Residents, Non-Reserved (%)</th>
<th>Extended Stay Travelers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FasTracks PNRs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US 35 BRT Phase II PARKING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Westminster Center (88th)/Sheridan)*</td>
<td>12.75%</td>
<td>2.25%</td>
<td>12.75%</td>
<td>9.00%</td>
</tr>
<tr>
<td>104th/Church Ranch *</td>
<td>12.75%</td>
<td>2.25%</td>
<td>12.75%</td>
<td>9.00%</td>
</tr>
<tr>
<td>Broomfield (115th)*</td>
<td>12.75%</td>
<td>2.25%</td>
<td>12.75%</td>
<td>9.00%</td>
</tr>
<tr>
<td>Petrons*</td>
<td>12.75%</td>
<td>2.25%</td>
<td>12.75%</td>
<td>9.00%</td>
</tr>
<tr>
<td>McCaslin*</td>
<td>12.75%</td>
<td>2.25%</td>
<td>12.75%</td>
<td>9.00%</td>
</tr>
<tr>
<td>Table Mesa*</td>
<td>12.75%</td>
<td>2.25%</td>
<td>12.75%</td>
<td>9.00%</td>
</tr>
</tbody>
</table>

Figure 6 – Enter FasTracks park-n-Rides Data tab

7. The Gross and Net Revenue tab is password protected and no changes are allowed. The tab is for viewing and printing results only.
8. The Daily Rate Calculator tab is an additional tab provided to calculate the blended daily parking rates. The calculated daily rates will then be entered into the Enter Base park-n-Ride Data tab and the Enter FasTracks park-n-Rides Data tab to obtain the results. The following variables can be changed to obtain the Blended Daily Parking Rates.

Parking Charges for Residents section:
- Monthly reserved parking charges for residents

Parking Charges for Non-Residents section:
- Daily parking charges for non-residents, non-reserved
- Percent split of non-resident, non-reserved transit patrons that will pay daily or monthly
- Monthly parking charges for non-residents, non-reserved
- Monthly parking charges for non-residents, reserved

SkyRide and FasTracks park-n-Rides only section:
- Resident parking charge/day for extended stay parking
- Percent split of resident and non-resident extended stay patrons
- Non-resident parking charges/day for extended stay parking

Figure 7 – Gross and Net Revenue tab

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross Revenue</th>
<th>Operating Expenses</th>
<th>Net Revenue</th>
<th>Gross Revenue</th>
<th>Operating Expenses</th>
<th>Net Revenue</th>
<th>Gross</th>
<th>Net</th>
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</thead>
<tbody>
<tr>
<td>2009</td>
<td>$1,778,927</td>
<td>$324,000</td>
<td>$1,454,927</td>
<td>$1,373,627</td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
<td>$1,460,356</td>
<td>$322,000</td>
<td>$1,138,356</td>
<td>$1,375,026</td>
<td></td>
<td></td>
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<tr>
<td>2011</td>
<td>$1,460,413</td>
<td>$322,000</td>
<td>$1,138,413</td>
<td>$1,375,026</td>
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<tr>
<td>2012</td>
<td>$1,436,029</td>
<td>$322,000</td>
<td>$1,114,029</td>
<td>$1,375,026</td>
<td></td>
<td></td>
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<tr>
<td>2013</td>
<td>$1,327,776</td>
<td>$322,000</td>
<td>$1,005,776</td>
<td>$1,375,026</td>
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<td></td>
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<tr>
<td>2014</td>
<td>$1,352,389</td>
<td>$322,000</td>
<td>$1,030,389</td>
<td>$1,375,026</td>
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<td></td>
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<tr>
<td>2015</td>
<td>$1,444,932</td>
<td>$322,000</td>
<td>$1,122,932</td>
<td>$1,375,026</td>
<td></td>
<td></td>
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<tr>
<td>2016</td>
<td>$1,239,217</td>
<td>$322,000</td>
<td>$917,217</td>
<td>$1,375,026</td>
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</tbody>
</table>

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11
CONCLUSIONS

The paper outlined a general process of developing the parking revenue model, identified the key issues considered and presented an overview of the model’s functional structure. However, not all the assumptions are fixed; many can be changed to create alternative revenue generation scenarios. The default numerical values used in the model provide only a base reference. The user may override these numerical values based on the actual survey data or sound engineering judgment.

Currently, RTD is implementing the Parking Management Programme at half of the existing park-n-Ride facilities (34 out of 74 park-n-Rides). The fee structure is slightly different than what is presented in this paper. The parking fees apply to all vehicles after 24 hours and parking is available on a first-come-first-served basis. No reserved parking is provided at this time.

The Parking Revenue Model developed as a part of the Parking Management programme to determine the estimated annual revenue is specific to the Regional Transportation District (RTD). The assumptions listed in the paper are for guidance and does not constitute a standard. Users must exercise a great caution in interpreting model inputs and outputs. It should also be noted that generation of revenue is not the purpose of the Parking Management Programme.

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NOTES

1 Source: The 2006 Urban Mobility Report, Texas Transportation Institute, Texas A&M University System, David Schrank and Tim Lomax. Web: http://mobility.tamu.edu

2 Source: Regional Transportation District (RTD) website http://www.rtd-denver.com/
BIBLIOGRAPHY


